AD-A184 371 CATEGORY ACCESSIBILITY AS IMPLICIT MEMORY(U) PURDUE UNIV LAFAYETTE IN DEPT OF PSYCHOLOGICAL SCIENCES E R SMITH ET AL. 06 JUL 87 TR-8-ONR N00014-84-K-0288 1/1

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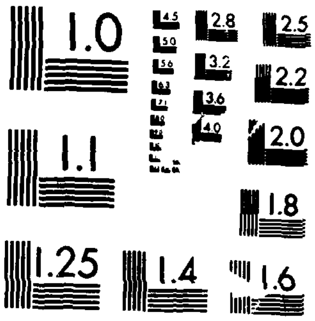

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REPORT DOCUMENTATION PAGE

Form Approved OMB No. 0704-0188

DTIC SELECTED SEP 1 0 1987 S D

1a. REPORT SECURITY CLASSIFICATION Unclassified	1b. RESTRICTIVE MARKINGS
2a. SECURITY CLASSIFICATION AUTHORITY	3. DISTRIBUTION/AVAILABILITY OF REPORT Approved for public release; distribution unlimited
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE	
4. PERFORMING ORGANIZATION REPORT NUMBER(S) TR-ONR-8	5. MONITORING ORGANIZATION REPORT NUMBER(S)
6a. NAME OF PERFORMING ORGANIZATION Purdue University Dept. of Psychological Sciences 6b. OFFICE SYMBOL (If applicable)	7a. NAME OF MONITORING ORGANIZATION Cognitive Science Program Office of Naval Research (Code 1142CS)
6c. ADDRESS (City, State, and ZIP Code) W. Lafayette, IN 47907	7b. ADDRESS (City, State, and ZIP Code) 800 North Quincy St. Arlington, VA 22217-5000
8a. NAME OF FUNDING/SPONSORING ORGANIZATION 8b. OFFICE SYMBOL (If applicable)	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER N00014-84-K-0288
8c. ADDRESS (City, State, and ZIP Code)	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO: 61153N; PROJECT NO: ; TASK NO: ; WORK UNIT ACCESSION NO:

11. TITLE (Include Security Classification)

Category accessibility as implicit memory

12. PERSONAL AUTHOR(S)

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13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Year, Month, Day)	15. PAGE COUNT
interim technical	FROM ____ TO ____	July 1987	27

16. SUPPLEMENTARY NOTATION

Submitted to Journal of Experimental Social Psychology

17. COSATI CODES			18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
FIELD	GROUP	SUB-GROUP	category accessibility, social cognition, social categorization, memory
05	10		

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

A person's likelihood of considering an ambiguous behavior a member of a trait category is influenced by earlier exposure to trait-related information. This category accessibility effect is a form of implicit memory: memory because it constitutes an effect of an earlier experience, and implicit because the task is presented as a judgment rather than a memory task, and in fact the effect can occur without the perceiver's awareness of the prior (priming) episode. This paper reports an experiment that puts category accessibility in the context of other types of implicit memory. Subjects studied trait words either by generating them from behavioral instances or simply by reading the traits. They were then tested with two different implicit (category accessibility and word-fragment completion) and one explicit (free recall) memory measures. As predicted, the results showed dissociations among the tests in the effects of the study-task manipulation. The results are interpreted as supporting a procedural

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20. DISTRIBUTION/AVAILABILITY OF ABSTRACT ☒ UNCLASSIFIED/UNLIMITED ☐ SAME AS RPT ☐ DTIC USERS	21. ABSTRACT SECURITY CLASSIFICATION unclassified
22a. NAME OF RESPONSIBLE INDIVIDUAL Dr. James Lester	22b. TELEPHONE (Include Area Code): 202-696-4503 22c. OFFICE SYMBOL: ONR 1142CS

DD Form 1473, JUN 86 Previous editions are obsolete. SECURITY CLASSIFICATION OF THIS PAGE

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Category Accessibility as Implicit Memory

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6 July 1987

This research was supported by the Office of Naval Research under contract N00014-84-K-0288 and by the National Science Foundation under grant BNS-8613584 We are grateful to Carol Bormann for her assistance in conducting this experiment ar to Roddy Roediger for helpful comments on an earlier draft. Correspondence regarding this article should be sent to Eliot R. Smith, Department of Psychological Sciences, Purdue University, West Lafayette, Indiana 47907.

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Category Accessibility as Implicit Memory

Abstract

A person's likelihood of considering an ambiguous behavior a member of a trait category is influenced by earlier exposure to trait-related information. This category accessibility effect is a form of implicit memory: memory because it constitutes an effect of an earlier experience, and implicit because the task is presented as a judgment rather than a memory task, and in fact the effect can occur without the perceiver's awareness of the prior (priming) episode. This paper reports an experiment that puts category accessibility in the context of other types of implicit memory. Subjects studied trait words either by generating them from behavioral instances or simply by reading the traits. They were then tested with two different implicit (category accessibility and word-fragment completion) and one explicit (free recall) memory measures. As predicted, the results showed dissociations among the tests in the effects of the study-task manipulation. The results are interpreted as supporting a procedural memory viewpoint that integrates implicit and explicit memory in a common theoretical framework. Several types of social phenomena may usefully be conceptualized as involving implicit memory.

Category Accessibility as Implicit Memory

The effect of priming on category accessibility has proven to be one of the most-studied topics in social cognition. Since the early experiments by Higgins, Rhole and Jones (1977) and Srull and Wyer (1979), the category accessibility (CA) effect, as we will call it for brevity, has been an important basis for theory construction within social cognition (Higgins & King, 1981; Wyer & Srull, 1986).

The effect itself is simple, readily replicable, and somewhat counterintuitive, which may help account for its popularity with researchers. The basic paradigm involves exposing subjects (under some pretext) to materials related to a social category, usually a trait like hostility. For example, subjects may read trait words related to the target category (Higgins et al., 1977), or may unscramble "scrambled sentences," like leg break arm his (Srull & Wyer, 1979), that form descriptions of behaviors that are related to the trait. Subjects are then told that they will participate in a second, unrelated experiment involving person perception. This is the CA test. Subjects read a description of some behaviors that are ambiguously related to the target category, and rate the character who performs the behaviors on a series of scales. The key dependent measure is the rating on the target trait itself (i.e., hostility) and its synonyms. Experiments like this reliably find that priming (the earlier exposure to trait-related materials) causes subjects to rate the ambiguous behaviors higher on the target trait, compared to control, unprimed subjects. The effect is of particular interest because (at least in some versions; Srull & Wyer, 1979) it can last over a 24-hour delay between priming and test. It also does not depend on subjects' ability to recall the priming materials (Higgins, Bargh, & Lombardi, 1985) or even on their ability to report the identity of the primes, as when they are presented in brief flashes followed by a pattern mask (Bargh & Pietromonaco, 1982).

CA effects have frequently been interpreted in terms of the activation of general trait schemas or constructs in the subject's memory (Higgins et al., 1985) or, equivalently, in terms of the trait schema's position in a Storage Bin in memory (Wyer & Srull, 1986). However, in prior work we have made the point that other theoretical interpretations are also possible (Smith & Branscombe, in press; Smith, 1987) and may fit the data better in some cases. Smith and Branscombe argued that the effects in the Srull and Wyer version of the paradigm could be due to the strengthening of cognitive procedures for inferring traits from behaviors. Smith performed computer simulations that demonstrated that another alternative, the storage and retrieval of experiences as in Hintzman's (1986) general model of memory, could also account for some properties of CA effects.

In this paper, we have three goals. (a) One is to demonstrate that CA effects can be obtained in a very different paradigm, priming a far greater number of traits than previous experiments. (b) We also wish to provide strong tests of hypotheses derived from the procedural model of CA effects outlined in Smith and Branscombe (in press). (c) Finally, we would like to link CA effects to a set of theories and empirical findings in cognitive psychology, under the general heading of implicit memory. We believe that this framework is likely to prove useful to theorists and researchers working within social cognition.

Implicit Memory

We will start with the latter goal. CA is an <u>implicit memory test</u> by definition (Schacter, 1987, p. 501). This means that performance on the CA test is influenced by an earlier experience (the priming event) but that subjects are not explicitly told to search or use their memory for the priming materials in performing the task. A

variety of tasks that have been studied in the literature meet this definition and therefore qualify as implicit memory tests. One example is word fragment completio (e.g., Tulving, Schacter, & Stark, 1982), where subjects are shown a word with some letters deleted (e.g., __ s s __ s s __ __) and are asked to fill in letters to complete an English word (assassin). Performance on this task is facilitated by having read the word on a study list. Other implicit memory tasks are described by Schacter (1987).

Of particular interest are dissociations between implicit and explicit memory measures (e.g., between word fragment completion performance and recall or recognition). Performance on implicit memory tests may follow a different time cou and may respond in different or even opposite ways to the manipulation of experimental conditions, compared to explicit memory for the same stimuli (Jacoby, 1983; Jacoby & Witherspoon, 1982). As noted above, a similar dissociation has been demonstrated between the effect of priming on a CA test and the subject's recall of priming information (Higgins et al., 1985). A major theoretical enterprise in the cognitive literature has involved accounting for such dissociations both in normal subjects and in amnesics, in whom many types of implicit memory are unimpaired in contrast to their profound deficits in explicit memory performance (Graf, Squire, & Mandler, 1984).

So far, we have simply provided a label that seems to describe CA tests. To generate predictions for CA tests from the implicit-memory framework we need to draw a further distinction, Jacoby's (1983) differentiation of data-driven from conceptually driven tests. Data-driven tests are those in which subjects must access th target item from perceptual information (e.g., perceptual identification--reading a wor presented in a brief flash--or word fragment completion). These tests tend to be highl sensitive to the perceptual details of the prior (priming) presentation of the word (e.g.,

its modality or typeface). That is, priming effects on word fragment completion tend to be larger when study and test presentations share the same modality (e.g., visual presentation) and typeface, compared to when these attributes differ between study and test (Roediger & Blaxton, 1987a). Recognition memory, in contrast, can be almost unaffected by a shift from auditory study presentation to visual presentation at test (Jacoby & Dallas, 1981).

Conceptually driven tests are those, like recall, in which subjects access the word from conceptually related information. That is, they retrieve the studied item via its links to other items or schematic structures in memory (cf. Srull, Lichtenstein, & Rothbart, 1985). These tests are highly sensitive to the amount of conceptual processing (e.g., elaboration) that the subject performed on the prior exposure, as in typical depth-of-processing effects on recall or recognition. However, they are typically quite insensitive to the perceptual details of the presentation, even such major aspects as visual versus auditory modality.

Both explicit and implicit memory tasks can involve data-driven and conceptually driven components (Roediger & Blaxton, 1987b). However, the typical explicit memory tasks that have been studied (recall and recognition) are predominantly conceptually driven. This is clearest in the case of free recall, where there are no data (cues) provided for subjects at all; only conceptual information in memory can be useful in recalling the studied information. Recognition involves visual cues, but its classification as primarily conceptually driven rests on observations like its insensitivity to shifts in modality and other surface features between study and test, and its strong dependence on deeper (elaborative, conceptual) processing at the time of study. Implicit memory tasks like perceptual identification and word fragment completion, on the other hand, are more data driven.

Within this conceptual framework (Jacoby, 1983; Roediger & Blaxton, 1987b) dissociations between explicit and implicit memory are attributed to the difference between data-driven and conceptually driven tests, rather than to the explicit versus implicit nature of the tests per se. Performance on a particular test is expected to benefit from prior study to the extent that similar processes (i.e., data-driven versus conceptually driven) are applied to the item at study and at test. So one would predict that elaborative study (e.g., generating an item from conceptual cues, forming a visual image of its referent) would aid conceptually driven tests more than data-driven tests, whereas study processing that made more use of the visual features of the item (e.g., simply reading it) would benefit data-driven tests relatively more than conceptually driven tests. Anderson's (1987) results show, in a similar way, that performance on transfer tests depends on the overlap of processes performed during study and those required by the tests.

To test directly whether the implicit versus explicit or the data-driven versus conceptually driven nature of the test is the key variable, Blaxton (in Roediger & Blaxton, 1987b) performed an experiment using all four possible test types formed by crossing the two factors. The tests included free recall (explicit, conceptually driven) and WFC (implicit, data driven). The explicit, data-driven test was a cued recall test in which the cue visually resembled the target word. For example, if copper was the target, CHOPPER might be given as a cue; subjects were instructed that the meaning of the cue word was irrelevant and only its visual appearance mattered. The implicit, conceptually driven test was a test of general knowledge; e.g., "What metal makes up 10% of yellow gold?" (copper). For this test (as for the WFC test) subjects were given typical implicit-memory instructions: to give their best answers to the questions rather than to answer with words from the study list (which would have made it an explicit memory task).

The four test types were crossed with a study manipulation. Some words were studied with no context (i.e., COPPER), others were studied in the context of a semantic associate (i.e., TIN-COPPER), and subjects had to generate still other words from semantic cues along with the word's first letter (i.e., TIN-C________). Data-driven processing should be greatest in the no-context study condition and least in the generate condition, with context in between; conceptually driven processing should show the reverse pattern.

Blaxton's findings were very clear. Items that had been generated at study produced the best performance on the conceptually driven tests, free recall and general knowledge. However, the pattern was reversed for the two data-driven tests, WFC and visually cued recall. Here performance was best for words that had been read without context at study, and worst for words that had been generated. In this experiment, then, explicit and implicit memory tests did not show different patterns of performance when this variable was unconfounded with the data-driven versus conceptually driven nature of the tests. The results fit well with the idea that performance is facilitated to the extent that the type of *processing given the item is* similar at study and at test.

<u>Category accessibility and implicit memory</u>

On its face, CA is clearly a conceptually driven test. It requires the subject to respond with the target trait from conceptual cues (a trait-related behavior) rather than from visual information (the letters that spell the trait word). Therefore, the above framework predicts that study tasks involving trait generation should facilitate CA performance more than should reading the trait word. Smith and Branscombe (in press) tested this hypothesis. *Though the language is somewhat different, our findings* in that paper and their theoretical interpretation resemble those of Blaxton. In

Experiment 2 we primed a single trait construct (hostility) either by having subjects read hostility-related trait words or by having them unscramble scrambled sentences *that formed hostility-related behaviors*. These are analogous *to read* and *generate* conditions respectively, the latter because we assume that as subjects form the hostility-related sentences they conceptually categorize them as hostile. Thus later performance on the CA test, which depends on conceptually driven processing, should be *facilitated* most by study in the behavior priming condition. This is what the results indicated. The generate (behavior-prime) condition produced a priming effect that lasted 3 min in Experiment 2 and 15 min in Experiment 1, while the effect of reading the trait words was evident only at a 15-sec delay in Experiment 2 and not at all in Experiment 1. Thus, the conceptually *driven* CA test was most *strongly influenced by conceptually* driven study processing (generation), as this framework would predict.

In the experiment reported in this paper, to investigate CA effects with a design analogous to those in other experiments on implicit memory, we had each subject study a large number of trait constructs, sixteen. Previous experiments have exposed each subject to just one. In addition, the format of the CA test differs from prior research. Here subjects read a behavior description and freely generated the trait they thought the behavior implied. This procedure is closer to a real-life person perception situation, *in contrast to the usual CA tests in which the target trait is given to subjects* on a rating scale and they are asked for a quantitative rating. We believe that in everyday interaction the real issue is whether or not people spontaneously make a particular trait inference given a behavior, not the quantitative judgment they will make when they are explicitly asked to reflect on the extent to which the trait applies.

Subjects studied the traits under two conditions (read the trait word versus generate it from behaviors) and were tested with WFC and CA tests as well as free

recall. We predicted a crossover interaction similar to that obtained by Blaxton and by Jacoby (1983). Reading should be better than generation for the WFC test, and generation better than reading for the CA test. This will show process specificity of priming: study facilitates later memory performance to the extent that it uses the same processes. We also predict that generation should help free recall more than reading does; this is based on results cited above that classify recall as a conceptually driven test.

Method

Design

The design is a 3 x 3, with the factors being study condition (trait studied by being read, generated, or not studied at all, within subject) and test type (CA, WFC or free recall, between subjects). Each group of subjects who participated together was assigned to the same test condition, because the procedure differed for each test type. Because subjects were not randomly assigned to sessions and therefore to test types, comparisons are strictly valid only between study conditions within each test type, not across test types.

Materials

For the final set of materials, we needed 24 trait words, each with (a) a set of three behaviors implying the trait, to be used in the generate study condition; (b) an ambiguously trait-related behavior as a stimulus for the CA test; and (c) a fragmented version of the word for the WFC test. For (a), we constructed sets of three behaviors for each of a larger number of traits. Pilot subjects (N=72) read these sets of behaviors together with the first letter of the trait word, with instructions to write down the trait. We discarded materials that led to incorrect identification by a substantial

number of subjects. For the 24 traits used in this experiment, an average of 85% of pilot subjects correctly completed the word. In the pilot test as well as in all scoring in this experiment, trait words sharing the same root were counted as the correct trait (e.g., skilled=skillful, prideful=proud) but no other synonyms were counted to reduce the necessity for making subjective judgments in scoring. It is very difficult to construct social materials involving traits and behaviors that will be perceived identically by all subjects. The fact that a few subjects failed to get the correct trait simply lowers the mean scores in the generate condition, working against the hypothesis for the CA measure.

For (b) and (c), we selected ambiguous behaviors and word fragments based on the responses of a different group of pilot subjects (N=115) so that the proportions of unprimed subjects giving the correct responses were in the range of 5-40%, leaving room for priming to move the proportions upward. Finally, the 24 traits were divided into three lists of eight traits each for counterbalancing study conditions.

An example of the materials for the trait religious is as follows:

Generate:

read from the Bible to his children daily

followed the Ten Commandments reverently

attended church three times a week R

CA test: bowed his head in a moment of silence before the meal

WFC test: _ e l _ g i o u _

Procedure

Subjects (N=87, 35 females) were tested in groups averaging 9 persons (ranging from 1 to 17) and participated in partial fulfillment of a course requirement. They received booklets containing written instructions for each task and were paced through

the tasks by a female experimenter. First came the study task. Subjects were told that this research concerned the way people process information about other people, and that we often receive information about others in two forms: traits and behaviors. They were told that they would see information which would consist of trait words intermingled with sets of three behaviors and an initial letter. Subjects were to read each trait word and rate it as positive, negative, or neutral in terms of its desirability as a personal characteristic, by writing +, -, or 0 opposite the trait. For each set of behaviors, they were to think of the trait that was implied, using the initial letter as a clue. They were instructed <u>not</u> to write the trait word, but to rate it as before. Each study list contained eight trait words (for the read condition) and eight sets of behaviors (the generate condition). The remaining eight traits were not studied at all. The three lists of eight trait words were rotated through these three conditions, with counterbalancing conditions distributed at random within each experimental session.

After all subjects had completed the study task, which took approximately 4-5 minutes, they were told that a second part of the experiment (whose nature was unspecified) would come later. The experimenter said that before that, a fixed amount of time had to elapse and there would be some tasks to fill that time. First was an arithmetic task. Subjects repeatedly subtracted seven from the beginning number 995 for one min, until the experimenter told them to stop.

The procedure for the rest of the experiment diverged for different groups of subjects at this point. The type of test subjects received was a between-subjects factor; one group of subjects completed each type of test first. Each group received a second test as well, to permit comparisons between tests for the same subjects, before being debriefed and dismissed. The conditions are (CA) CA and FR tests; (FR) FR and CA tests; (WFC) WFC and FR tests.

<u>CA test</u>. Subjects were told that to fill the rest of the time before the "second part of this experiment," they would be completing a questionnaire to help the researchers develop trait and behavior materials for use in future experiments similar to this one. This cover story was used to conceal the fact that this was actually our key dependent measure, the CA questionnaire, and to account for the partial overlap of content between the study list and the questionnaire, which subjects might notice. The test consisted of 24 behavior descriptions, each ambiguously related to one of the traits (see the example above). Instructions were to write a word representing a personality trait or characteristic that the subject would infer from each of the behaviors. The experimenter paced subjects through the questionnaire at 10 sec per item, a total of four min. Subjects in this condition then received the free recall test (described below), presented as the "second part of this experiment."

<u>WFC test</u>. Subjects in this condition were told that to fill in the rest of the time before the second part of this experiment, they would be completing a questionnaire to help the researchers develop some materials for use in a future experiment. Subjects were instructed to complete each word fragment with an English word if they could do so within the time allotted. They were paced through the 140-item WFC questionnaire in which the 24 target trait words were embedded, with 8 sec per item, a total of [illegible] min. They then received the free recall test, as in the procedure for the CA group.

<u>FR test</u>. After completing the arithmetic task, subjects were told that the second part of the experiment was next. They were instructed to recall the traits they had studied or generated in the first part of the experiment, and were given five min to write them. After three min of this time, the experimenter urged them to keep trying: "You have 2 minutes left in the memory test. Keep trying to recall the traits, because studies have shown that people can often recall things even after they think they can't remember any more, if they keep on trying."

Finally, these subjects completed the CA questionnaire, introduced (as above) as a questionnaire that would help the researchers develop materials for future experiments.

Results

Subject gender had no significant main effects or interactions for the CA or WFC measures (all p's > .20). For recall, there was a marginal main effect ($p = .09$) indicating that males recalled more words, and a marginal interaction with the counterbalancing factor ($p = .07$), such that this difference was larger for one set of materials. None of these effects qualify the effects of interest (study condition or test type).

The results from the test completed first by each subject are of primary interest. Relations between performance on successive tests from the same subject will be referred to only briefly, because *performance on the second test may be influenced by* the first one. In an overall 2x3 MANOVA, considering only the read and generate conditions (because the control condition has no meaning for the recall test), the predicted study condition x test type interaction had $F(2, 78) = 13.34$, MSE = 2.62, $p < .001$. We proceeded to test the hypotheses more specifically by examining comparisons within each test type. All means appear in Table 1.

Table 1 about here

CA test. For subjects who completed the CA test first (N=28), the effect of study condition had a MANOVA $F(2, 24) = 8.23$, $p < .002$. Both reading and generating traits resulted in significantly more of the target traits being generated than the

control condition, which represents the base rate of nonstudied traits being generated. The generate condition mean was significantly higher than read, $F(1, 25) = 4.50$, MSE = 3.62, $p < .05$. This conceptually replicates the findings of Smith and Branscombe (in press, Experiments 1 and 2) where conditions analogous to generate also produced stronger effects on CA measures.

WFC test (N=29). The overall MANOVA $F(2, 25)$ was 17.82, $p < .001$. In contrast to the CA results, *reading was superior to generation for the WFC test* ($F(1, 26) = 21.67$, MSE = 3.08, $p < .001$). In fact, generation differed only trivially from the control condition ($F < 1$). Clearly, the pattern differs substantially from that of the CA test.

FR test (N=30). As has been repeatedly demonstrated (e.g., Roediger & Blaxton, 1987b) free recall is better following generation than following reading. In this experiment the difference between these two conditions was significant, with $F(1, 27) = 5.77$, MSE = 4.39, $p < .03$. The intrusion rate was negligible (2 intrusions of nonstudied words from the target list out of 255 words recalled).

Discussion

The shape of the empirical results is very clear. The predicted crossover interaction was obtained, with generation resulting in better CA and free recall performance, while reading resulted in better WFC performance. One way to describe the results, following the introduction, is to note that performance is best when the type of processing given the item at study matches that required by the test. Reading encourages relatively data-driven processing, while generation is a more conceptually driven study task. WFC is a data-driven test, while CA and free recall are conceptually driven. But we wish to go beyond this level of description to consider

possible theoretical accounts of the results. We will organize the discussion around four different accounts.

<u>Explicit memory strategy</u>

Might the CA and WFC results reflect an explicit memory strategy? These are labeled tests of implicit memory because performance does not <u>require</u> conscious access of the fact that the word had been studied, but subjects could still decide to search memory in order to complete these tests. This idea, which is closely related to the notion of demand characteristics, can be easily dismissed with respect to the WFC test. First, we embedded the 24 target items in a list of unrelated words more than five times as long; searching one's memory for studied items in order to complete the WFC items would be a very poor strategy. Second, the pattern of means in Table 1 contradicts this idea. Words that were generated were <u>best</u> recalled, but were not completed on the WFC test any more often than nonstudied words. If subjects used recall to complete WFC items, this pattern would not occur.

This suggestion is harder to dismiss with respect to the CA test. CA and recall are high in the same conditions, as predicted from the notion that they are both conceptually driven tests. However, at least three arguments can be raised. First, CA effects have been shown to be independent of recall for the priming materials (Higgins et al., 1985). The read versus generate results in this experiment parallel those of Smith and Branscombe (in press), who used methods similar to those of past experiments (including the Srull & Wyer scrambled sentence primes and the hostile "Donald" paragraph as the dependent measure). It is unparsimonious to suggest that while other CA results in the literature do not depend on explicit memory, these results, which parallel the others, do.

Second, our CA test asked subjects to write a trait that was implied by the behavior, which subjects can readily do even for behaviors associated with nonstudied

traits. This is not, like WFC, a test with only one right answer, so it is implausible tha subjects would effortfully search their memory for a trait from the study list to use when they can easily perform the task without such a search. Also, Schacter (1987, p. 510) cites several experiments (Graf & Mandler, 1984; Schacter & Graf, 1986) as suggesting that subjects generally do not use an explicit memory strategy on implicit memory tasks.

Third and perhaps most convincing, there is substantial independence between CA and FR results for those subjects who completed both tests. For example, over 40% (81/196) of the studied traits that were used on the CA test were not recalled on the FR test, <u>even when FR came after CA</u>. This strongly suggests that these were not traits that subjects chose to use on the CA test because they could recall them from the study list; instead, the traits were not accessible to explicit memory but were called up by the different retrieval cues offered by the CA test items. Similarly, 50% of the studied traits that were recalled were not used on the CA test even when CA followed FR. If subjects were responding to experimental demands to use recalled traits from the study list on the CA test, one would expect them to use most of the traits that they could recall for the appropriate behaviors on the CA test.

Finally, another way of looking at this evidence is to omit from consideration all traits that the subject recalled. Note that this procedure works strongly against the hypothesis, for two reasons. (a) Recall is highest in the generate condition where CA is also hypothesized to be high. (b) We are examining the CA-FR test sequence so that the CA test results of primary interest are uncontaminated, but this means that studied traits that the subject generated on the CA test might have been particularly likely to be recalled later--in effect they received an additional study trial. Even so, CA performance is still better in the generate than in the read condition when one

considers only nonrecalled traits. Of the nonrecalled traits in the generate condition, 37% (42/113) were used on the CA test, compared to 26% (39/148) of those in the read condition. This comparison falls just short of significance, $chi^2(1) = 3.50$, $p = .06$.

Thus, we conclude that the CA and WFC results truly reflect implicit memory rather than subjects responding to experimental demands and using an explicit memory strategy.

Activation

Schacter (1987) discusses three theoretical viewpoints on implicit memory phenomena in general. We will discuss them with particular reference to the current CA results, under the headings of activation, multiple memory systems, and procedural memory. Activation theories held that priming on implicit memory tests is due to the automatic activation of information (schemas, constructs) in memory. Prevailing theoretical accounts of CA effects involve activation (Higgins et al., 1985; Wyer & Srull, 1986), the latter if one includes the notion of a schema's position in a memory Storage Bin as a type of activation because its predicted effects are similar (i.e., increased accessibility for future use). Activated information is readily accessible, but (because the activated item is a generic knowledge structure) does not carry information about context and so cannot serve as a basis for explicit memory for the priming information.

Activation theories can most comfortably account for priming effects that are relatively short-lived and automatic (i.e., not dependent on elaborative study processing; Schacter, 1987, p. 511). They fit the CA effects found in the Higgins paradigm, where priming trait words are read in a context that discourages elaborative conceptual processing (e.g., they are labeled as distractor words whose meaning is irrelevant) and have effects that are generally short-lived (up to a few minutes; cf. Smith &

Branscombe, in press, note 5). Activation theories have great difficulty accounting for the longer-term effects of other types of manipulations (Srull & Wyer, 1979; Smith & Branscombe, in press, Experiment 1) and for study-test interactions like that demonstrated in this paper (see also Jacoby, 1983; Roediger & Blaxton, 1987b). If one type of study processing (say generation) activated the target item to a greater extent than reading, one would expect to observe parallel performance across the different implicit memory tests, contrary to the actual results.

Multiple memory systems

Other theorists believe that two or more separate memory systems (often identified with Tulving's semantic versus episodic memory) underlie implicit and explicit memory performance. Explicit memory tasks like recall are said to be mediated by episodic memory, because they require retrieval of information about the time and context in which an experience occurred. Implicit memory tasks are mediated by a semantic memory system, because they rely on long-term knowledge concerning words and concepts. This notion can explain observed dissociations between explicit and implicit memory performance, since they depend on different and somewhat independent memory systems. However, there are a number of difficulties in this account (Schacter & Tulving, 1982; McKoon, Ratcliff, & Dell, 1986). For one thing, both the current experiment and Blaxton (in Roediger & Blaxton, 1987b) found dissociations between two implicit, "semantic" memory tasks (here, CA and WFC) and parallel patterns of results between an implicit, "semantic" and an explicit, "episodic" task (CA and FR). Such findings are quite unexpected on the multiple-memory-systems view.

Procedural memory

The procedural viewpoint is that described in the introduction and elsewhere (Smith & Branscombe, in press; Roediger & Blaxton, 1987b). Both explicit and implicit

memory depends on traces left by particular processing episodes. What is important is not just the identity of the item that was processed (as the activation view would claim) but the nature of the processing that was performed. When a test makes use of a particular type of processing that was performed during study, performance will benefit. Obviously, study-test interactions of the sort demonstrated here are easily interpretable within this framework. So are priming effects that are long lasting and context sensitive, since the hypothesized traces of processing episodes will be expected to have those properties (Jacoby, 1983; Roediger & Blaxton, 1987b). This viewpoint has more problems incorporating short-lived priming effects of the sort that the activation view explains well, and an adequate account of implicit memory phenomena in general may have to include both procedural and activation components (cf. Schacter & Graf, 1986).

To make the procedural view somewhat more concrete, Jacoby (1983) and Roediger and Blaxton (1987b) elaborate the distinction between data-driven and conceptually driven processing, as described above. Smith and Branscombe's (in press) focus was more specific, since in that paper we considered only the CA test rather than several different types of implicit memory. There, we described the specific cognitive process (represented as a production; cf. Smith, 1984) that we believe is strengthened by generate-type study tasks and tested by CA tasks. The process is a content-specific procedure for inferring a particular trait (e.g., hostility) from behaviors with the relevant features. This is obviously one kind of conceptually driven process, because it accesses the target concept from conceptually related information (hostile behaviors) rather than from perceptual data (e.g., the letters "h", "o", "s", ...). Thus, the discussion in this paper puts the formulation of Smith and Branscombe (in press) into a broader framework.

On this procedural-memory view, then, what is stored in memory during the study task to influence later CA performance? Study involves performing certain processes (reading the trait word from visual information or generating it from related behaviors). That experience leaves traces--perhaps in the form of strengthened cognitive procedures (Anderson, 1987; Smith & Lerner, 1986; Smith, 1984)--that facilitate performance of the same processes in the future. When the subject reads the ambiguous behavior on the CA test, the target trait is more likely to come to mind if it has been previously generated from behaviors. Note that the CA measure used here indexes the extent to which the trait "pops into the subject's head" in a clearer way than conventional rating-scale measures, which directly present the trait to subjects.

Of course, in this experiment the read condition also led to more use of the target traits on the CA test (compared to nonstudied traits). Our read condition, where subjects were instructed to read the traits and rate them as positive or negative, certainly requires some degree of conceptual processing (though not as much as the generate condition). It therefore influenced the conceptually driven CA test to some extent. A different type of study task, like reading the word to make letter or rhyme judgments, would be expected to produce more data-driven processing but less conceptual processing, so it should have a smaller effect on a CA test. That is exactly what Smith and Branscombe (in press, Experiment 2) found: the study task of making sound-similarity judgments on trait words had <u>no</u> effect on a CA measure.

Conclusions

This experiment leads to several conclusions, which will be commented on briefly. <u>Study that involved generating an item was best for CA and FR performance, while reading the item was best for WFC</u>. This shows that what one does with an

item--the procedures that are used in studying--makes the difference in later test performance. In contrast, activation theories propose that any processing of an item should automatically activate its representation in memory and leave it more accessible for future use by any type of test.

The pattern of results supports the procedural memory interpretation. CA and other types of implicit and explicit memory performance depend on memory traces of processing episodes, which can be usefully classified as relatively data-driven versus conceptually driven in order to generate empirical predictions (Roediger & Blaxton, 1987b).

This experiment is procedurally very different from prior CA experiments, in its demonstration that sixteen different traits can simultaneously be primed and influence a CA test. The use of this novel paradigm puts CA in the context of the literature on implicit memory (Schacter, 1987). The three conceptual accounts discussed by Schacter have all been proposed or at least mentioned with respect to CA effects in social cognition, and *further contact between these two literatures may be* beneficial for both.

CA is a conceptually driven implicit memory test. As such, for some purposes it is methodologically preferable to the general-knowledge test used by Blaxton, since it does not have right and wrong answers. Everyone has an opinion as to what trait the test behavior implies, so subjects may be less likely to use an explicit memory strategy of searching remembered items from the study list to try to complete the item correctly.

Implicit memory may be involved in socially relevant phenomena. It is obvious that the CA effect itself could influence impression formation in real social interaction, for social perceivers' past experiences may influence trait inferences. Schacter (1987) mentions mood, phobias, and the formation of self conceptions as other areas in which implicit memory may be implicated. Stereotyping may be another example. Past experiences with members of particular social groups (or people with particular physical characteristics, etc.) may leave traces that will affect later reactions to similar others without the perceiver being aware of the influence or even, perhaps, being able to retrieve the earlier experiences as explicit memories. Lewicki (1985) has experimentally demonstrated just such an effect. This conception of stereotypes as implicit memories for particular past experiences has a very different flavor than the traditional viewpoint that stereotypes involve configurations of traits that are learned as characteristics of broad social groups. Its implications are yet to be explored, but they may include the notion that stereotypes are fluid, changeable, and responsive to recent or highly accessible experiences.

In general, implicit memory phenomena, with their tantalizing message that our judgments and behavior are influenced by our past experiences in ways of which we are not explicitly aware, promise to remain close to the center of research interest in both social and cognitive psychology.

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Table 1

Results for Category Accessibility,

Word Fragment Completion, and Free Recall

Tests Following Three Study Conditions

	Study condition		
Test	Generate	Read	Control
Category Accessibility	4.18	3.43	2.71
Word Fragment Completion	3.45	4.97	3.31
Free Recall	4.87	3.57	--

Note: All means are out of a possible 8.

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